Course Syllabus
Gyanmanjari Institute of Technology
Semester-4 (Diploma)

Subject: Structural Mechanics - DETCV14208

Type of course: Major core

Prerequisite: Engineering Mechanics

Rationale:

Structural Mechanics is built based on Engineering Mechanics. In this subject, students will study how flexible structures like beams and columns behave under different loading conditions. By understanding things like slope and deflection of beams, they learn about the stiffness of structures, which helps in analyzing the structure's safety aspect. Structural Mechanics builds a base for students before moving towards the designing aspect.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Sr. No	Course Content	Hrs.	% Weightage
1	**Simple Stresses and Strains** Direct stress, Linear strain, Elasticity, Elastic limit, Hook's law, Modulus of Elasticity or Young's modulus, Stress Strain curve for mild steel bar under tension with numerical problems. Lateral stress and strain, Poisson's ratio, Volumetric strain, Bulk modulus, relation between three moduli and numericals. Basics Concepts of	14	20%

	Shear Stress, Shear Strain & Modulus of rigidity. Concept of composite and compound section, modular ratio and numericals.		
2	**Moment of Inertia** Importance of Moment of Inertia Axis of symmetry, Centroidal axis and axis of reference. Parallel Axis Theorem & Perpendicular Axis Theorem Formulas to calculate Moment of Inertia of solid and hollow rectangle, square, circle, triangle shapes (without derivations). Moment of Inertia of symmetrical and asymmetrical I-section, Channel section, T-section, Angle section, Hollow sections and Built up sections about Centroidal axis and any other reference axis using Parallel axis theorem. Polar Moment of Inertia of solid & hollow circular sections.	12	20%
3	**Shear Force and Bending Moment** Statically Determinate and statically indeterminate beam examples. Concept of Bending Moment and Shear Force in beam. Sagging and Hogging Bending Moment. Positive and Negative Shear Force Calculation of Bending Moment and Shear Force at various sections of beam for cantilever simply supported and overhang beam subjected to point load and/ or u.d.l. S.F. & B.M. Diagram for above beams Point of Contra-flexure & its importance	14	25%
4	**Bending & Shear Stress in Beam** Concept and theory of pure bending, assumptions, Bending equation (without derivation), Section Modulus, Bending stresses and their nature, Bending stress distribution diagram, Concept of moment of resistance and simple numerical problems using bending equation, Shear stress equation (without derivation), relation between maximum and average Shear stress for rectangular and circular section. Shear stress equation (without derivation), relation between maximum and average Shear stress for rectangular and circular section.	12	20%
5	**Column & Strut** Column and Strut, radius of gyration, slenderness ratio, Short Column and Long Column End conditions & effective length of column. Mode of failure in column. The limitations of Euler's theory for short column, Euler's formula for crippling load of long columns and numericals. Rankin's formula for buckling load of short & long columns and numericals	08	15%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Model Building and Testing:** Students Group construct structural models, such as beams and columns, using provided materials. They test these models under load, analyze their behavior in terms of stress, strain, and deformation, and submit a detailed report on their findings.and Upload it to the GMIU Web Portal.	10
2	**Case Study Analysis** Faculty will assign students a real-world case study on a structural failure or success, such as a bridge collapse or a megastructure's construction. Students will research and analyze the structural design, materials, loading conditions, and factors contributing to the outcome. They will then prepare a report on the selected structure and upload it to the GMIU Web Portal.	10
3	**Field Visit to Construction Site:** Faculty will organize an industry visit to a local construction site where students can observe different types of structures being built. Encourage them to identify various structural elements, loading conditions, and construction techniques discussed in class.After the visit, facilitate a discussion where students can reflect on how theoretical concepts apply to real-world construction projects. And prepare report and upload them on the GMIU Web Portal.	10
	Total	30

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	20%	25%	25%	20%	10%	-

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Course Outcome:

After learning the course, the students should be able to:	
CO1	Apply fundamental principles of mechanics, equilibrium and statics to practical problems of engineering.
CO2	Determine moment of inertia of a different geometrical shape and its use in engineering problems.
CO3	Draw and Interpret shear force and bending moment diagrams and determine the bending and shear stresses in beams for various types and loading conditions.
CO4	Apply principles of mechanics and equilibrium to get responses of rigid and deformable bodies
CO5	Determine the load-carrying capacity of columns in structural design.

List of Practical: -

Sr.no	Descriptions	Unit No.	Hrs
1.	Conduct tension tests on a given sample of mild steel and draw a stress-strain curve.	1	04
2.	Compute Polar Moment of Inertia of Fly Wheel.	2	04
3.	Practice of examples is to be assigned for calculating MOI of various shapes	2	06
4.	Practice of examples is to be assigned for drawing shear force and bending moment diagrams of different beams subjected to various loading conditions	2	06
5	Determine the compressive strength of concrete.	3	04
6.	Practice of examples is to be assigned for analyzing various trusses using	4	06

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done on the basis of Active Learning Assignment.

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] Theory of Structures by R S Khurmi, S.Chand Publishing, Delhi (2000), ISBN:
[2] Strength of Materials by Dr. R. K. Bansal, Laxmi Publications(P) Ltd. New Delhi(2005),
[3] Strength of Materials (Mechanics of Solids) by R S Khurmi, N. Khurmi, S Chand
[4] Engineering Mechanics statics by R. C. Hibbeler, McMillan Publication.
[5] Engineering Mechanics by S S Bhavikatti
[6] Strength of Materials by G. H. Ryder
[7] Introduction to Mechanics by M K Verma